

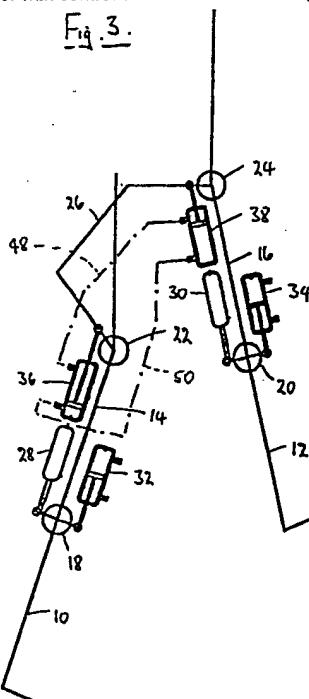
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(71) Applicant Hugh Steeper Limited (Incorporated in the United Kingdom) Queen Mary's University Hospital, Roehampton Disability Centre, Roehampton Lane, London, SW15 5PL, United Kingdom	(56) Documents cited GB 2206494 A GB 1454913 A GB 1382430 A GB 1284878 A EP 0229537 A US 4854428 A US 4775037 A US 4557257 A
(72) Inventor Martin Kemp	(58) Field of search UK CL (Edition L) A5R RFA RFB INT CL ⁶ A61F Online databases: WPI
(74) Agent and/or Address for Service Bromhead & Co 19 Buckingham Street, London, WC2N 6EF, United Kingdom	

(54) Orthotic or prosthetic walking brace

(57) The brace 10, 12, 14, 16 which may be an orthosis or prosthesis comprises hip joints 22, 24 and knee joints 18, 20, and has hydraulic means 32, 34, 36, 38 provided in or on the brace for effecting relative movement between different parts thereof. The hydraulic means may comprise double-acting cylinder and piston units, hydraulic connections being provided between the cylinders of respective units together with control valves. The units acting on the knee joints may cooperate with automatically-engaging knee locks.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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Fig. 1.

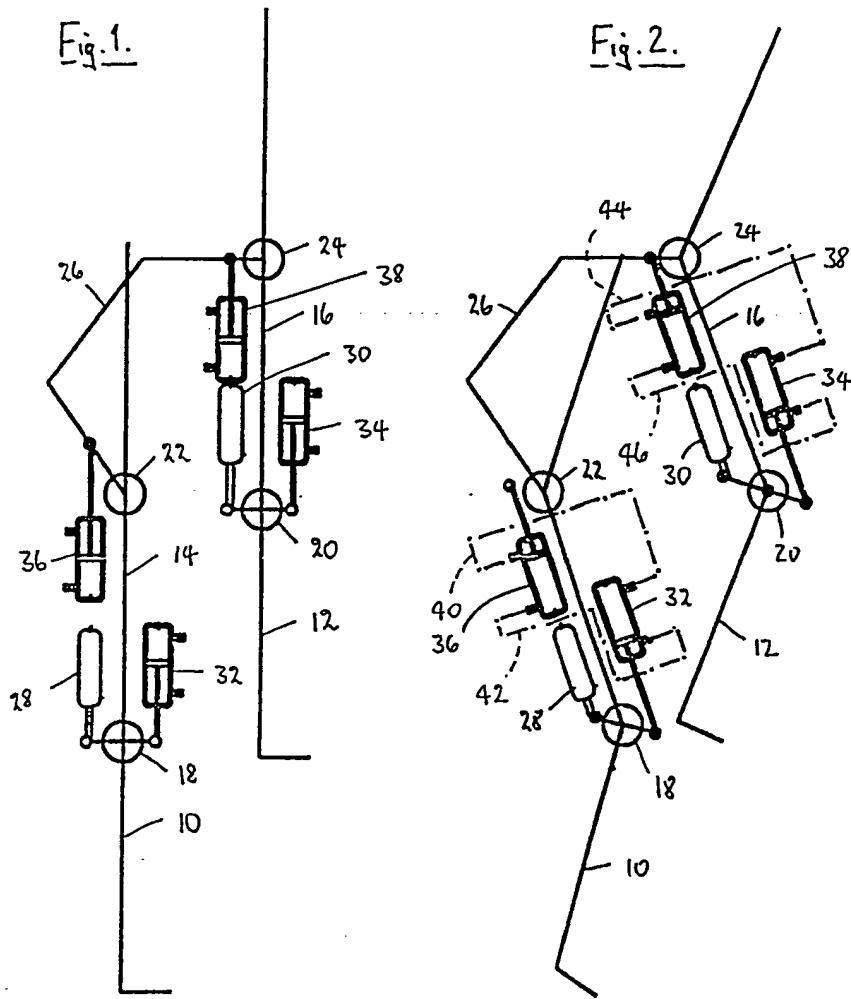


Fig. 2.

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Fig. 3.

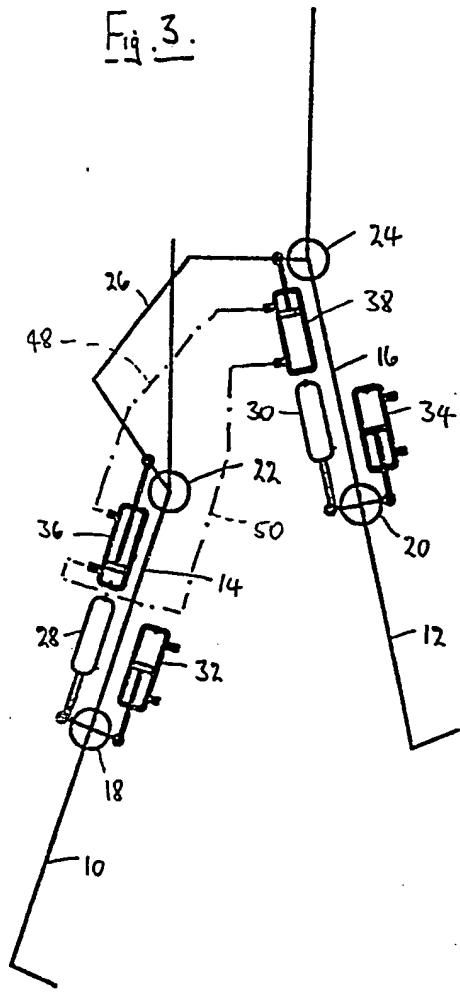
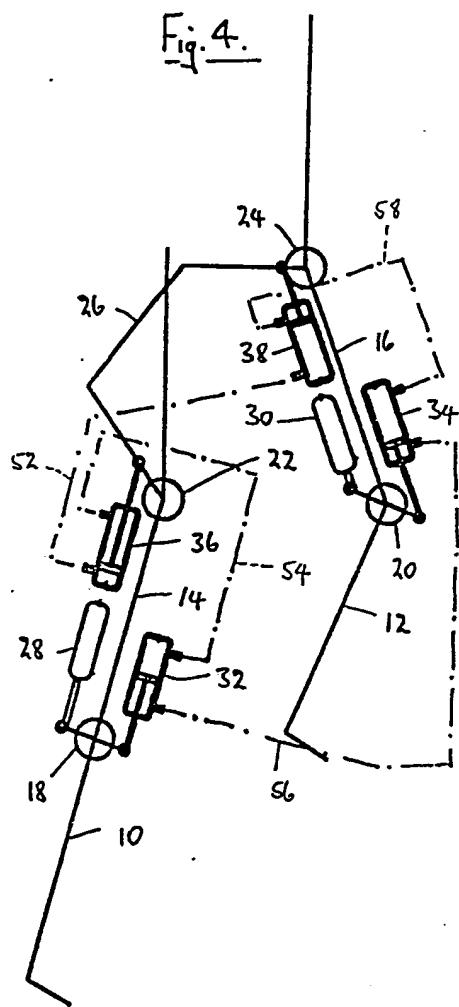


Fig. 4.



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An Orthotic or Prosthetic Walking Brace

This invention relates to an orthotic or prosthetic walking brace.

In GB-A-2 206 494 we have described an orthotic or prosthetic walking brace which provides a natural and efficient method of ambulation for, *inter alia*, paraplegic patients. In the particular walking brace illustrated in that prior publication, the movement of hip and knee joints is co-ordinated by means of a push-pull cable or rod with knee extension being ensured by a spring member co-operating with automatically-engaging knee locks to prevent flexion of the knee. The walking brace also includes hand-operated locks for the hips.

The present invention is concerned with a development of the walking brace described in GB-A-2 206 494.

Broadly, our new invention is directed to a walking brace, especially but not exclusively an orthosis or prosthesis comprising a hip joint and a knee joint, wherein hydraulic means are provided in or on the brace for effective relative movement between different parts of the brace.

Preferably the hydraulic means take the form of double-acting hydraulic cylinder-and-piston units which are associated with respective limbs of the brace. Hydraulic connections are provided between the cylinders of these units together with control valves by means of which

communication can be switched between the individual cylinders. In this way a patient wearing the brace can walk in a much more natural manner than is possible with the walking braces at present available.

An example of a walking brace in accordance with the invention is shown in the accompanying diagrammatic drawings, in which :

Figure 1 is a perspective view from one side of a walking brace which is not dissimilar from that shown in GB-A-2 206 494 except that it has hydraulic units for actuating the limbs of the brace; and

Figures 2 - 4 are similar views to Figure 1 to illustrate different relative positions of the limb members of the brace as different hydraulic units forming part of the brace are actuated.

The walking brace shown in Figure 1 comprises two shin members 10 and 12 and two thigh members 14 and 16. The shin member 10 is connected by a knee joint 18 to the thigh member 14, while the shin member 12 is connected by a knee joint 20 to the thigh member 16. The thigh members 14 and 16 are provided with respective hip joints 22 and 24. A belt member or back support 26 is arranged to extend round the back of the patient at waist level and is connected at its ends to the hip joints 22 and 24. A spring member 28, 30, preferably in the form of a "gas strut" or pneumatic spring, is arranged to act on each knee joint 18, 20 in co-operation with automatically-engaging knee locks (not shown).

In order to effect relative movement between different parts of the brace in order that a patient may walk with the aid of the brace and may also move easily between sitting and standing positions, four double-acting hydraulic cylinder-and-piston units 32, 34, 36 and 38 are mounted on the brace. As will be seen, the hydraulic unit 32 is connected to the knee joint 18, the hydraulic unit 34 is connected to the knee joint 20, the hydraulic unit 36 is connected to the back support 26 near the hip joint 22, and the hydraulic unit 38 is connected to the back support 26 near the hip joint 24.

Hydraulic connections - not shown in Figure 1 - are provided between the respective hydraulic units so that the latter can be actuated in order to cause relative movement between different parts of the brace. Thus, Figure 2 illustrates the way in which hydraulic connections 40 and 42 between the hydraulic units 32 and 36, as well as hydraulic connections 44 and 46 between the hydraulic units 34 and 38 can be used to cause the flow of hydraulic fluid into and out of those units in such a way that bending of the brace takes place at the knee joints 18 and 20.

Figure 3 illustrates hydraulic connections 48 and 50 between hydraulic units 36 and 38 in order to cause a walking movement of the thigh and shin members about the hip joints 22 and 24. Similarly, Figure 4 illustrates hydraulic connections 52, 54, 56 and 58 between the four hydraulic units in order to effect bending movement of one limb member about the knee joint 29 during the walking

movement illustrated in Figure 3.

It will thus be seen that relative movement between different parts of the brace is effected by hydraulic means, namely, the four hydraulic units 32, 34, 36 and 38 which are interconnected with each other by appropriate hydraulic lines so that hydraulic fluid can be passed to and fro between different pairs of hydraulic units. Such flow control is preferably carried out by means of one or more hydraulic valves provided at an appropriate place - or appropriate places - on the hydraulic brace.

In one particular hydraulic brace in accordance with the invention, bypass valves or orifices are provided on the knee cylinders. These allow the patient to control the unlocking and flexion of the knee on the swinging leg according to the force, and consequently the speed, that they apply to the thigh through the driving hydraulics. Such a construction will ensure that, when the leg is moved quickly, the bypass orifice will resist fluid flow and cause a pressure differential across the knee cylinder which is sufficient to overcome the lock and gas strut, thus flexing the knee. When the speed falls, then the gas strut will extend and lock the knee. At the same time, on the stance phase leg, there will be an orifice which allows greater flow, thereby allowing free flow of the hydraulic fluid to the stance hip cylinder. The respective gas strut will ensure that the stance phase leg is maintained in a locked position.

This form of construction allows low-speed

manoeuvring and walking backwards to be carried out with locked knees for safety. A further advantage is that the use of hydraulic valves and/or variable orifices allows the development of alternative control strategies for the brace without modifications to the basic design. For example, simple valves could allow the knees to be locked in any position - which is very important for driving - or simple bypass valves could allow free movement of the hips whilst sitting or lying on a bed, which is of great advantage when putting the brace on or taking it off.

As in GB-A-2 206 494, the gas struts or pneumatic springs 28 and 30 bring about extension of the knee in co-operation with the automatically-engaging knee locks provided on or near the two knee joints 18 and 20.

Claims

1. A walking brace, especially but not exclusively an orthosis or prosthesis comprising a hip joint and a knee joint, wherein hydraulic means are provided in or on the brace for effecting relative movement between different parts of the brace.
2. A walking brace according to claim 1, in which the hydraulic means take the form of double-acting hydraulic cylinder-and-piston units which are associated with respective limbs of the brace, hydraulic connections being provided between the cylinders of these units together with control valves by means of which communication can be switched between the individual cylinders.
3. A walking brace according to claim 1 or claim 2 comprising two shin members and two thigh members, one shin member being connected by a first knee joint to one of the thigh members, and the other shin member being connected by a second knee joint to the other thigh member with the two thigh members having respective hip joints.
4. A walking brace according to claim 3, in which a belt member or back support is arranged to extend round the back of the patient at waist level and is connected at its ends to the hip joints.
5. A walking brace according to claim 3 or claim 4, in which a pneumatic spring, "gas strut" or other spring member is arranged to act on each knee joint in co-operation with automatically-engaging knee locks.

6. A walking brace according to claim 4 or claim 5, in which four double-acting hydraulic cylinder-and-piston units are mounted on the brace, one unit being connected to the first knee joint, a second unit being connected to the other knee joint, a third unit being connected to the back support near one hip joint, and a fourth unit being connected to the back support near the other hip joint.

7. A walking brace according to claim 1 substantially as described herein with reference to the accompanying drawings.

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Patents Act 1977
[Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

GB 9121202.7

Relevant Technical fields	Search Examiner
(i) UK CI (Edition K) A5R (RFA, RFB)	L V THOMAS
(ii) Int CI (Edition 5) A61F	
Databases (see over)	Date of Search
(i) UK Patent Office	11.1.93
(ii) ONLINE DATABASE: WPI	

Documents considered relevant following a search in respect of claims 1-7

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2206494 A (HUGH STEEPER LTD) see line 20 page 2 - line 4 page 3, line 4 page 6 - line 5 page 7, lines 15-20 page 7	1
X	GB 1454913 (BLATCHFORD) see lines 6-20 page 2	1
X	GB 1382430 (A B FRIBERG) see lines 91-123 page 3	1, 2
X	GB 1284878 (BLATCHFORD) see lines 33-54 page 1	1
X	EP 0229537 A (CHAREIRE) see line 35 column 3 - line 32 column 4 and lines 47-56 column 5	1
X	US 4854428 (HORRATH) see whole document	1, 2
X	US 4775037 (STENBERG) see line 63 column 1 - line 43 column 2	1
X	US 4557257 (FERNANDEG et al) see lines 34-68 column 2	1

Category	Identity of document and relevant passages	Relevant to claim(s.)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

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